MALLOY AERONAUTICS LTD

DRONE 3

A quick start guide

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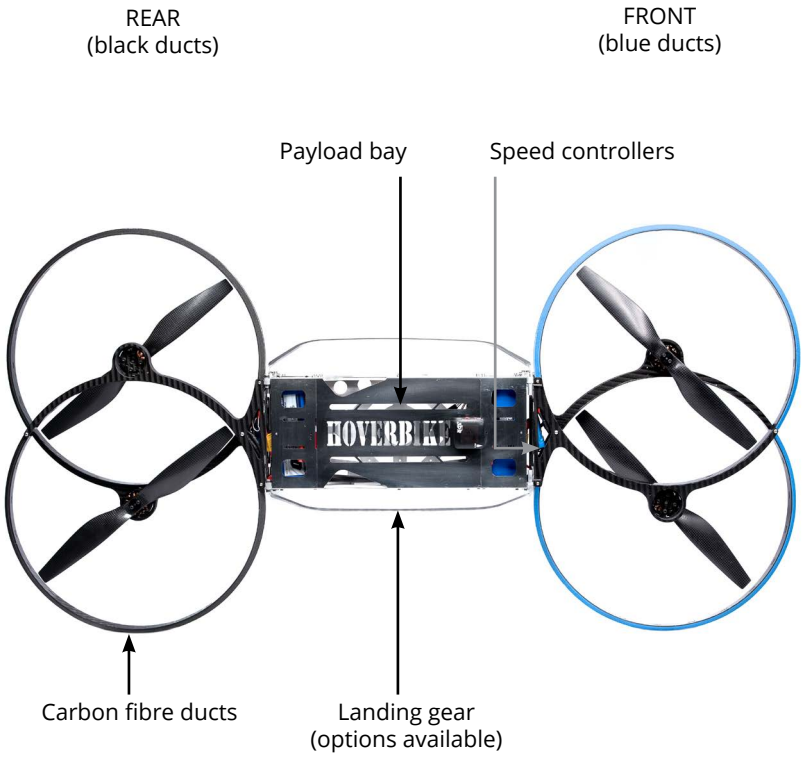
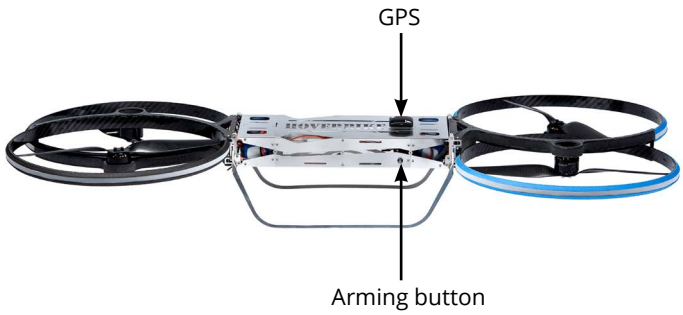
SYSTEM OVERVIEW

The Hoverbike Drone is an unconventional quadcopter due to the overlapping blades and protective propeller ducts. However, under the covers it is functionally no different to a traditional quadcopter. It has 4 brushless DC motors that drive the carbon fibre propellers. These are driven by 30A motor speed controllers, and these speed controllers are in turn controlled by the Pixhawk flight controller.

BIRD'S EYE VIEW

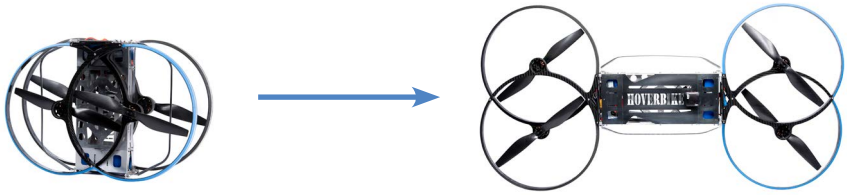


SIDE VIEW



WHAT'S IN THE BOX

The Hoverbike drone will arrive folded - see page 6 for unfolding instructions.



Macro micro microcontroller

Batteries

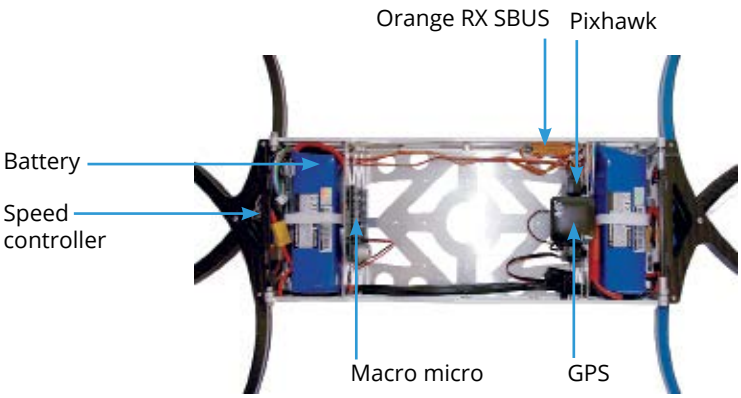
Micro SD adapter

USB cable

Pixhawk interface cables for optional external hardware

2mm hex key

The Hoverbike Drone will arrive with all the parts placed appropriately as shown on the image below (the middle section with plates off).



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CARING FOR YOUR HOVERBIKE DRONE

Unfolding and folding

To fold, release the pins on the bottom side, then fold section over top.



Release the pins on the top side and partially fold section under.



Fold legs out and complete folding of section under.


Reverse the process to unfold.

Water and dirt

Please keep you Hoverbike Drone dry and clean. Dust and particulates can enter into the motor and bearings which can reduce the working life of your motors.

Structural integrity

Just like on a full size helicopter, you should pre-flight check your Hoverbike Drone before powering on. This would include checking for the following items:

- All screws tight
- Structural fatigue, such as cracks or bends due to heavy landings/crashes
- Motor bearings and mounts
- Propeller mounts
- Plugs and general condition of wires
- Correct operation of flight controller on startup

YOU AND YOUR DRONE

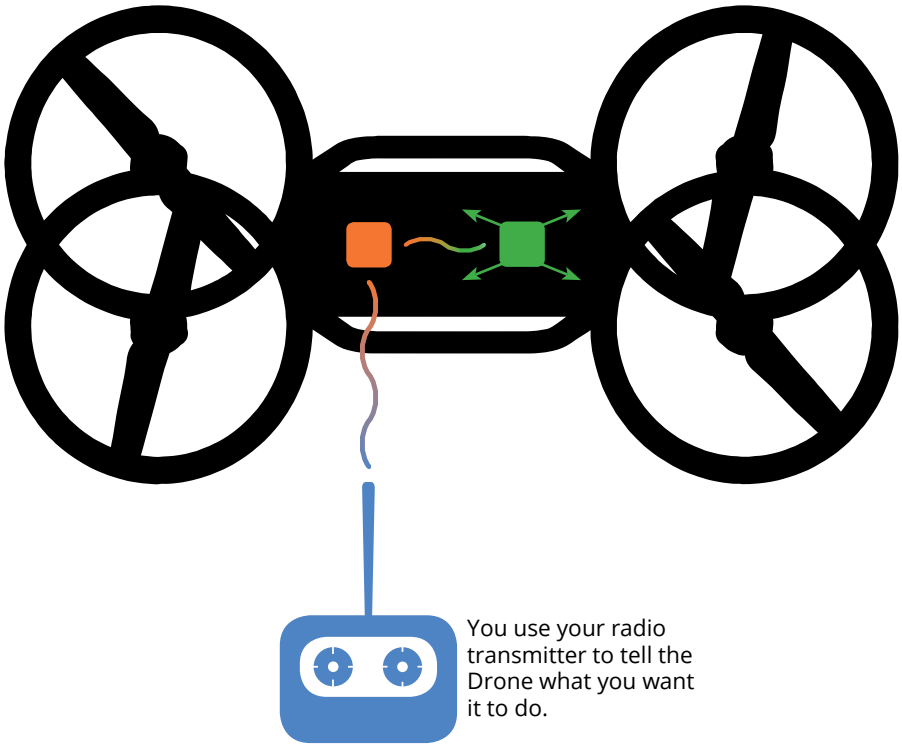
The Hoverbike Drone can be thought of as these three distinct items:

- Vehicle flight controller (vehicle's brains)
- Vehicle receiver (vehicle's mouth and ears)
- Your radio transmitter (your mouth and ears)

You use your radio transmitter (say a Spektrum DX6i, your phone, etc.) to talk to the Hoverbike Drone receiver. The Hoverbike Drone receiver hears this and then tells the vehicle flight controller what you want it to do. Now, just like talking to a person, there are limits on the distance to which you can communicate with your Hoverbike Drone. Please read your specifications on your choice of radio transmitter to determine just how far you can communicate with your vehicle's receiver. Luckily, our Hoverbike Drone can return to home if you go too far from one another. Please see https://pixhawk.org/users/rc_failsafe for how to setup your failsafe mode. However, it is best practice not to rely on this feature as many environmental conditions can change or obstruct your Hoverbike drone on its blind automated trip home!

Receiver - receives signal from your radio transmitter and translates it to the flight controller.

Flight controller - hears the signal from the receiver and tells the Hoverbike Drone what you want it to do.



You use your radio transmitter to tell the Drone what you want it to do.

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REMEMBER - SAFETY FIRST

Blades
The Hoverbike Drone uses carbon fibre propeller blades which are incredibly strong. Even when they spin at low speeds they are fast and sharp enough to lose a finger.

Where to fly
Always fly outside and in an open area, and in line of sight with your drone.

Flying over or near people and animals
Where possible, do not to fly over or close to people or property. Although the Hoverbike Drone is comparatively light to other drones of similar lift and size, it still weighs over 3kg when fully equipped for flight and can weigh up to 6kg! This can be a very dangerous object when either falling controlled or uncontrolled from the air. Although Malloy Aeronautics has tried to engineer a highly reliable system, there is always the chance that something could go wrong.
Children and animals have a fascination for drones of all types so keep landing and takeoff areas well clear. Ensure at all time you have somewhere safe to land in an emergency. Please check your local aviation regulations related to drones and/or RC helicopters.

Please: Always fly your Hoverbike Drone with the thought in the back of your mind that something may happen, and buffer yourself and your surroundings accordingly.

Environmental
Wind speed and gusting is always a problem for drones and this Hoverbike Drone is no exception. If you are unsure about the conditions it is best not to fly. Work gradually up in experience with different wind speeds and gusting so that you are confident in all conditions.
GPS satellites are not always in line of sight or atmospheric conditions may be such that your drone cannot lock onto sufficient GPS satellites before or during flight. Be ready to assume manual control if your drone loses GPS lock (by default it is set to land if GPS lock is lost while in a flight mode that uses it, and will start to descend down onto whatever objects or surface is below).

ALL INSTRUCTIONS HERE RELATE TO MODE 2 RADIO TRANSMITTER

FIRST TIME SETUP

In order to fly your Hoverbike Drone for the first time you will need to link and calibrate your radio transmitter to the drone. To do this you will need:

- Your chosen radio transmitter (Spektrum, Hitec, Futaba, etc.)
- A computer (laptop/pc) that can run the Mission Planner software (download from the web at http://ardupilot.com/downloads/?did=82)
- Your Hoverbike drone of course!

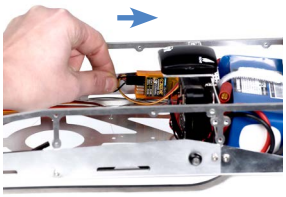
You will also need to ensure your batteries are charged. If you are new to RC (radio control) drones then you will probably need to purchase a battery charger. Please see page 12 ('Charging batteries') in this document for more information.

Binding your radio transmitter

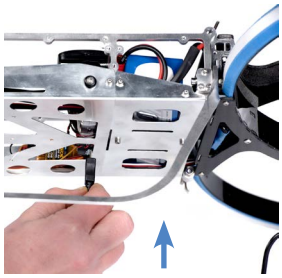
Binding is the process in which *your radio transmitter* is paired with a corresponding vehicle receiver so that a control link is made between the two. This needs to be done before you are able to control your Hoverbike Drone. The Hoverbike Drone will be shipped with an Orange RX receiver, ready to bind to your Spektrum radio transmitter. If you don't have a Spektrum radio transmitter, you will need to replace the Orange RX receiver with the one that corresponds to your radio transmitter.

Binding your radio transmitter to Pixhawk with Orange RX SBUS receiver

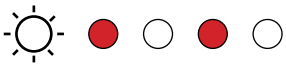
Plug the bind plug in to the receiver's bind/SBus channel and the signal cable to one of the other channels (to provide power to the the Orange RX receiver).



Connect the Pixhawk via the USB cable to your PC (this will power the receiver). The receiver should be blinking rapidly showing that it is ready to bind.



Receiver:



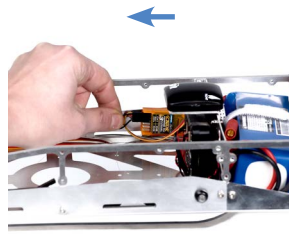
Caution: ensure your throttle stick and throttle trim is all the way down on your transmitter with the other sticks centered. *The receiver remembers these stick positions and if the receiver loses signal from your transmitter it will send these stick positions to the Pixhawk. The throttle trim needs to be lower than usual minimum throttle to tell the Pixhawk to go into failsafe mode.*

Whilst holding the bind/switch button, power on your transmitter (see your radio transmitter manual for details). Continue to hold the bind switch/button, the red light on the receiver should go solid after a few seconds. The receiver light MUST go solid for the bind process to be successful.

Receiver:

You can now release the bind button on your transmitter.

Unplug the bind *plug from the receiver* and plug the signal cable back in the bind/SBus port. The bind process is finished.



Return the throttle trim to centre.

Put the bind plug somewhere safe for if you need to bind a different transmitter to your Hoverbike Drone.

Optional:
Using a Spektrum remote (satellite) receiver

- A DSM2 receiver that supports a satellite receiver is currently required for binding.
- Plug the satellite receiver and the bind plug and the Pixhawk into the DSM2 receiver.
- Connect the Hoverbike Drone via the USB cable. The receiver should be blinking rapidly showing that they are ready to bind.
- Caution: ensure your throttle is all the way down on your radio transmitter. Whilst holding the bind/switch button, power on your transmitter (see your radio transmitter manual for details). Continue to hold the bind switch/button, the red light on the receiver should go solid after a few seconds. The receiver light MUST go solid for the bind process to be successful.
- You can now release the bind button on your radio transmitter.
- Unplug the DSM2 receiver from the Pixhawk and unplug the remote receiver from the DSM2 receiver
- Finally, plug the remote receiver into the Pixhawk SPKT/DSM on the front face.
- Place the receiver somewhere safe for if you need to bind a different transmitter to your remote/satellite receiver. *Note: The channel mapping is different for the Spektrum Satellite receiver and will require changing in Mission Planner.*

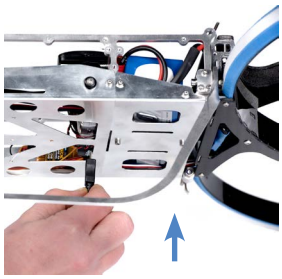
Calibrating your transmitter in Mission Planner

It is required that you calibrate your *radio transmitter* with the Pixhawk flight controller so that the Pixhawk flight controller can learn all your radio's control endpoints *by moving all stick and switches to their extreme positions.* Also, refer to the Pixhawk manual available at:

http://3drobotics.com/wp-content/uploads/2014/03/pixhawk-manual-rev7.pdf

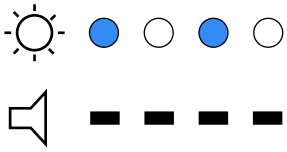
Install the Mission Planner software *on your computer* and connect the Pixhawk via the USB cable. The Mission Planner software can be found on the 3DR website or via the following link:
http://ardupilot.com/downloads/?did=82

Mission Planner allows you to configure and tune the flight controller and to program GPS waypoints of which your Hoverbike Drone can then fly. You can also download and analyze logged data.

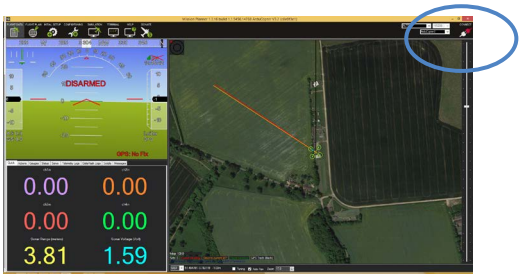


When you first connect the Pixhawk to your computer, your computer should install the drivers required. Once the drivers are installed and the Pixhawk is initialized, it should light up and the buzzer should tune.

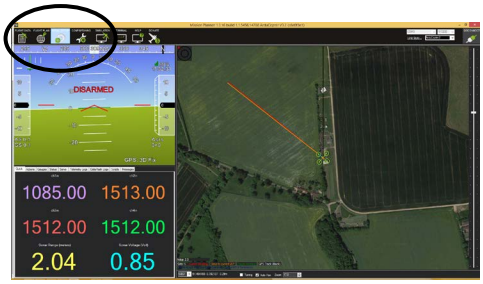
Pixhawk:



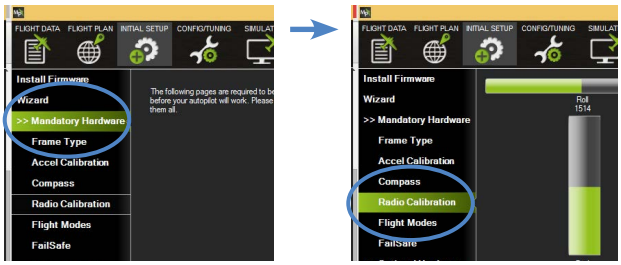
To connect to your Hoverbike Drone, go to the top left of your screen, and with AUTO selected in the drop down, click 'connect' to connect your Hoverbike Drone to the computer.



Click the Initial Setup tab at the top of the Mission Planner page.



Select the *Mandatory Hardware tab* down the left hand side where you should see *Radio Calibration*.



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Follow the radio calibration procedure as described in Mission Planner.

All other stages of the setup have been done for you. You are now ready to fly your own Hoverbike Drone.

Unplug USB cable from both the Pixhawk and the PC.

CHARGING BATTERIES

Batteries must be charged before use. The batteries are constructed from 6 lithium polymer cells giving 22.2 Volts and 25.2 Volts when fully charged without a load. The capacity of each battery supplied with the Hoverbike Drone is 3000 mAh. If available, it is recommended to set the charge current to 3 Amps and never to charge at over 15 Amps. We recommend charging with the balance leads connected.

When flying from two or more batteries in parallel, you need to ensure that the batteries have the same voltage (voltage per number of cells), energy capacity (mAH) and power capacity (C rating). Always check that the pack voltage is the same as the others (+/- 200mV).

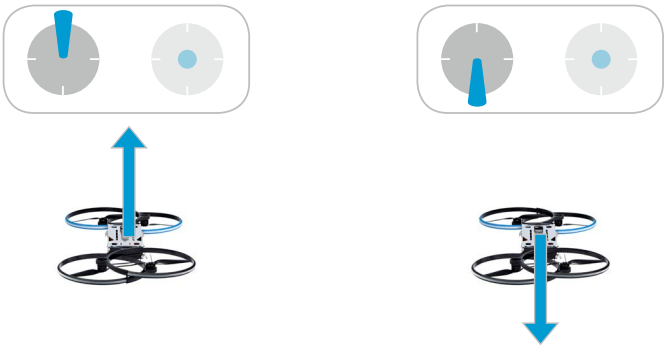
It is always best practice to label your batteries as a pair and to charge them both fully before flight.

Do not drain more than 80% of the batteries capacity.

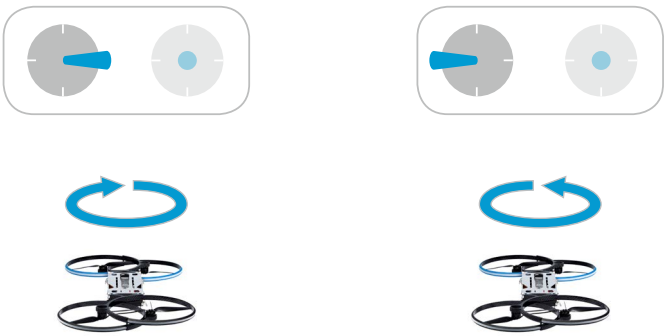
HOW THE CONTROLS WORK

MODE 2

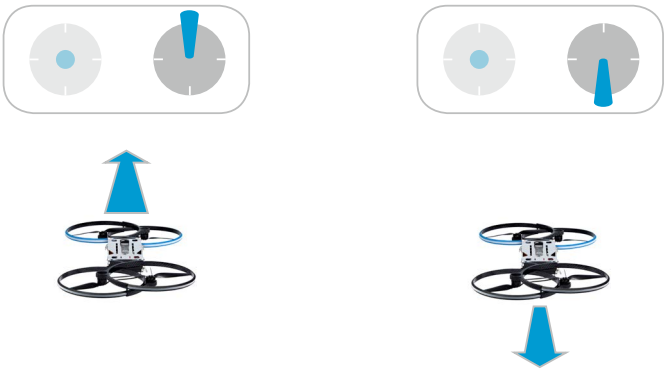
Throttle (height). Makes the Hoverbike Drone go up and down.



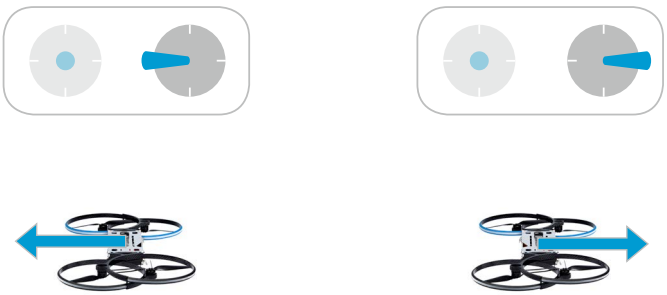
Yaw (turn). Makes the Hoverbike Drone turn.



Pitch (forward). Makes the Hoverbike Drone go forward and backward.



Roll (side). Makes the Hoverbike Drone go sideways.

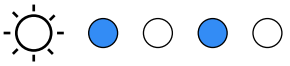


WARNING LIGHTS AND SOUNDS

The Pixhawk LED and sound meanings

Flashing red and blue.
Initializing. Please wait.

Double flashing yellow.
Error. System refuses to arm.



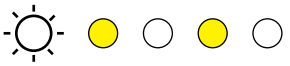
Flashing blue.
Disarmed.
Searching for GPS. Auto-pilot, loiter, and return-to-launch modes require GPS lock.

Flashing green.
Disarmed.
GPS lock acquired. Ready to arm. Quick double tone when disarming from the armed state.

Solid green. Plus single long tone.
Armed with GPS lock.

Ready to fly!

The Pixhawk failsafe lights and sounds



Flashing yellow:
RC failsafe activated.

Flashing yellow plus quick repeating tone:
Battery failsafe activated.

Flashing yellow and blue plus high-high-high-low tone:
GPS glitch or GPS failsafe

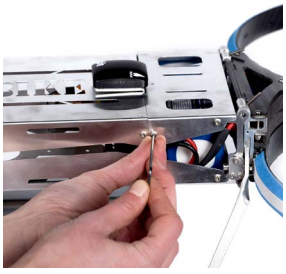
FIRST TIME READY TO FLY

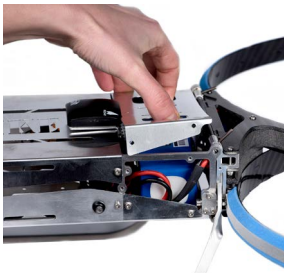
For your maiden flight and until you are confident with the controls, it is recommended that you fly your Hoverbike Drone in 'loiter' mode, this is how the Hoverbike Drone will arrive to you. In 'loiter' mode the flight controller will take care of keeping your Hoverbike Drone in the same place and at the same altitude but you have control of where it can go. Flight modes are controlled with Channel 5 on your transmitter - please see: http://copter.ardupilot.com/wiki/flight-modes/.
Read also the next section 'Before every flight'.

Take your Hoverbike Drone to an open flying area (half a soccer field is a good minimum size). You should choose a day with light or no wind, and the area should be clear of people and obstacles.

Ensure that the locking pins used for folding the drone are secured

Place your Hoverbike Drone on the ground and lift battery plates off, *plug in BOTH batteries.*

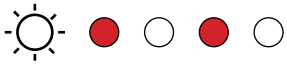




You should hear a tune from the Pixhawk buzzer. The *arming button* light will flash.

Pixhawk:

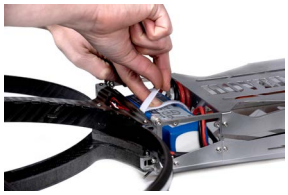
Arming button:



Now leave the Hoverbike Drone whilst the Pixhawk flashes red and blue. It should not be moved or knocked at this stage.

Pixhawk:

Once you hear and see the above then the battery cover plates can be replaced. (If desired the plates can be left off. However, ensure the batteries are secured.)



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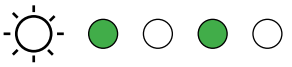
Do not move the Hoverbike Drone from this position; it should be left until the light on the Pixhawk flashes green. This time is required for GPS satellites to be acquired and for the home position to be logged, and the flashing green indicates that the correct number of satellites are acquired. The Hoverbike Drone will return to this position if commanded by you or by radio failure to return to launch (RTL), so make sure it is not positioned close to any thing that it may land on or fly into.

Pixhawk:



Now that the green light is flashing your Hoverbike Drone is ready to fly. Hold the *arming button until the button lights up* solid red and the motors sing out another tune, the motors should then remain quiet.

Arming button:

Motors:

Hold the yaw (left stick of your transmitter) fully to the right and down until you hear a long tone from the Pixhawk buzzer and the Pixhawk light goes solid green.

Pixhawk:

Pixhawk:

YOUR HOVERBIKE DRONE IS NOW ARMED AND READY TO FLY.

FLIGHT

This procedure is the same for every flight:

Slowly raise the throttle. Once above half throttle your Hoverbike Drone will take to flight. This may happen rapidly so keep a safe distance.

Once your Hoverbike Drone has ascended to around a meter or two slowly reduce the throttle so that the Hoverbike Drone hovers.

You can control your Hoverbike Drone with the right hand transmitter stick, twist it around by moving the left stick left or right (yaw) and move it up or down by moving the left stick up and down (height).

To land, slowly lower the throttle stick until your drone is safely back on the ground.

Please refer to 'How controls work on page 13.

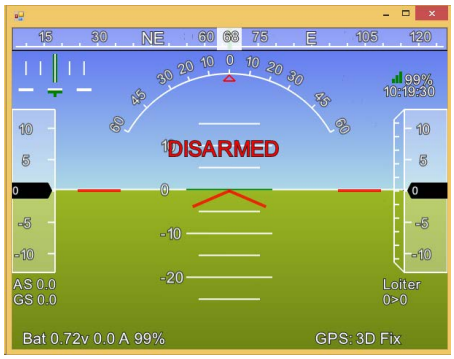
BEFORE EVERY FLIGHT

Below are the required steps for every flight. See unfolding/folding instructions on page 6.

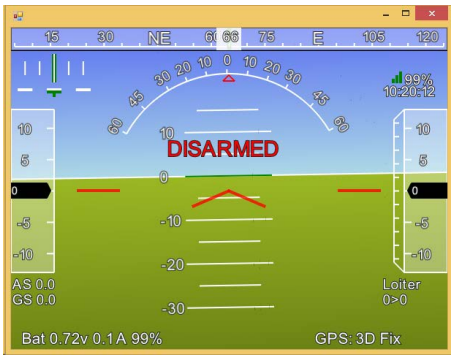
Start up

Note: Loiter mode is heavily dependent on the accelerometers being well calibrated. To check the calibration of your Hoverbike Drone's accelerometers connect it to Mission Planner and check the artificial horizon in the Flight D ata tab. The artificial horizon should match the red lines and the red arrows should point to zero ±1 ˚ when your Hoverbike Drone is on a flat and level surface.
Although we will have calibrated your accelerometers before shipping please check this before your first flight. If it is not completely level please re calibrate your accelerometers using the Initial Setup - Accelerometer Calibration tab in Mission Planner.

CORRECT



WRONG



Ensure that the locking pins used for folding the Hoverbike Drone are secured.

Connect the batteries.

Ensure that batteries are fully charged and strapped in.

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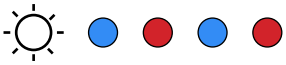
Leave the drone whilst the Pixhawk flashes red and blue, it should not be disrupted at this stage (after connecting the battery).

Pixhawk:

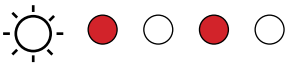


After connecting the batteries you should hear the motors start beeping, quickly followed by a tune from the Pixhawk buzzer. The motors will continue to sound and the arming button light will flash red.

Motors:

Pixhawk:

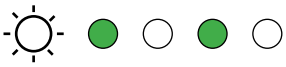
Arming button:



Once you hear and see the above then secure the cover plates.

Leave the Hoverbike Drone until the Pixhawk flashes green (acquires GPS satellites).

Pixhawk:



Arm for flight

Hold the arming button on the side until the button lights up solid red and the motors sing out a tune, the motors should then remain quiet.

Arming button:

Motors:

Hold the yaw (left stick of your transmitter) fully to the right and down until you hear a long tone from the Pixhawk buzzer and the Pixhawk light goes solid green.

Pixhawk:

YOUR HOVERBIKE DRONE IS NOW ARMED AND READY TO FLY!

DIFFERENT FLYING MODES

‘Loiter’ mode

‘Loiter’ automatically attempts to maintain the current location, heading and altitude. The pilot may fly the Hoverbike Drone in ‘loiter’ mode as if it were in ‘manual’ mode. Centering the sticks (pitch, roll, yaw) will continue to hold position. Good GPS signal, low magnetic interference on the compass and low vibrations are all important in achieving good loiter performance.

The pilot can control the position of the Hoverbike drone with the control sticks.

- Horizontal location can be adjusted with the Roll and Pitch control (right) stick with the default maximum horizontal speed being 5m/s. When the pilot centres the sticks the Hoverbike Drone will slow to a stop.
- Altitude can be controlled with the Throttle control stick as in AltHold mode
- The heading can be adjusted with the Yaw control stick

‘Stabilize’ mode

Some level of experience is necessary for this mode.

- Stabilize mode allows you to fly your vehicle manually, but self-levels the roll and pitch axis. Pilot’s roll and pitch input controls the flight angle of the Hoverbike Drone. When the pilot centres the roll and pitch stick, the vehicle automatically levels itself.
- Pilot will need to regularly input roll and pitch commands to keep the vehicle in place as it is not being held in position with GPS as in ‘loiter’ mode.
- Pilot’s yaw input controls the rate of change of the heading. When the pilot releases the yaw stick the vehicle will maintain its current heading.
- Pilot’s throttle input controls the average motor speed meaning that constant adjustment of the throttle is required to maintain altitude. If the pilot puts the throttle completely down the motors will go to their minimum rate and, if the vehicle is flying, it will lose altitude control and tumble.

‘Acro’ mode

High level of experience is necessary for this mode.

‘Acro’ mode (‘Rate’ mode) uses the radio transmitter sticks to control the angular velocity of the Hoverbike Drone. Release the sticks and the vehicle will maintain its current attitude and will not return to level. ‘Acro’ mode is useful for aerobatics such as flips or rolls, or aerial photography (FPV) when smooth and fast control is desired.

The throttle is completely manual with no compensation for tilt angle of the vehicle. If the pilot puts the throttle completely down the motors will go to their minimum rate.

Warning: ‘Acro’ is the most difficult flight mode to master and you can look forward to crashing multiple times before you get the hang of it. If you are unexperienced, please research more on ‘Acro’ mode.

Contents

Please see:
http://copter.ardupilot.com/wiki/flight-modes/
for information on flight modes available: Stabilize, Alt Hold, Loiter (& OF_loiter), RTL (Return-to-Launch), Auto.
Additional flight modes: Acro, Sport, Drift, Guided, Circle, Position, Land, Follow Me, Simple and Super Simple.

ABOUT THE HOVERBIKE DRONE

Batteries

The Hoverbike Drone requires 6S batteries (6 cell Lithium), as it needs the 22.2V to drive the motors and propellers at the correct RPM. Using a lower cell count/battery voltage will cause the Hoverbike Drone to be underpowered due to the slower spinning propellers. To ensure long flight times, a high energy density battery is preferred. To achieve 14 minutes flight time with no load you will need 6000mAh batteries. This could be either 1x 6000mAh 6S or 2x 3000mAh 6S. To increase flight time to 19 minutes you will need to either increase the pack mAh or put more packs in parallel. The Hoverbike Drone is currently wired up to accept two packs in parallel.
As this is a quadcopter, a high power density (C rating) is not required. The peak current draw with the standard two packs (3000mAh) in parallel is less than 45A. This means that the batteries are using just over 1/3rd the rated current of a 20C pack.

Flight controller

The Hoverbike Drone uses the Pixhawk flight controller. We tested our own flight controller and the DJI flight controller and found the Pixhawk to be the superior controller in terms of functionality, control and user interaction. If you want to find out more about this controller, please see http://store.3drobotics.com/products/3dr-pixhawk.

Speed controllers

The Hoverbike Drone uses 30A speed controllers. These speed controllers are opto-isolated, which means that they have control electronics buffered from the 22V power rail by opto-isolators.
These motor controllers can be swapped out with any other common brand of speed controller if the user is experienced enough and has the desire to modify their drone. It must be said however that if one does modify their drone, Malloy Aeronautics will not uphold any warranty or liability.

Brushless motors

The brushless motors we use are a 550W peak, 20A continuous, 6 cell capable.

Propellers

The propellers are 356mm (14”) carbon fibre.

Wiring

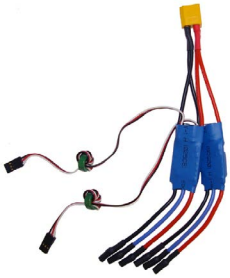
The stock wiring system takes power from two 6S battery packs in parallel and passes this through a power module. This power module does two things. The first is to monitor the voltage and current to tell the Pixhawk flight controller what the current state of the batteries is. The second thing is to convert a little of the voltage to 5V to power the flight controller. After the power passes through the power module it continues on to the motor speed controllers to drive the motors.

Spares

You can purchase the following spares from our website:

Motors

Motor speed controllers



Propellers

Ducting

Landing gear
(skids and folding legs)

Flight controller

GPS

Macro micro

Carry bag

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Links

Pixhawk
http://store.3drobotics.com/products/3dr-pixhawk

Pixhawk user manual
http://3drobotics.com/wp-content/uploads/2014/03/pixhawk-manual-rev7.pdf

Pixhawk failsafe mode setup
https://pixhawk.org/users/rc_failsafe

Mission Planner
http://ardupilot.com/downloads/?did=82

Flying modes
http://copter.ardupilot.com/wiki/flight-modes/

Support + inquiries

For customer support and inquiries please do not hesitate to contact us at:
info@hover-bike.com
+44 (0) 1628822477
+44 (0) 7741035576
Monday to Friday 9:00 - 17:00 (timezone = UK, +0 UTC/GMT, summertime + 1hr)

HAPPY FLYING!

The Hoverbike Team

MALLOY
AERONAUTICS

WWW.HOVER-BIKE.COM